CDM – Executive Board

CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-SSC-PDD)
Version 03 - in effect as of: 22 December 2006

CONTENTS

Annexes

Revision history of this document

Version Number	Date	Description and reason of revision
01	21 January 2003	Initial adoption
02	8 July 2005	• The Board agreed to revise the CDM SSC PDD to reflect guidance and clarifications provided by the Board since version 01 of this document. • As a consequence, the guidelines for completing CDM SSC PDD have been revised accordingly to version 2. The latest version can be found at <http://cdm.unfccc.int/Reference/Documents>.
03	22 December 2006	• The Board agreed to revise the CDM project design document for small-scale activities (CDM-SSC-PDD), taking into account CDM-PDD and CDM-NM.

SECTION A. General description of small-scale project activity

A.1 Title of the small-scale project activity:

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Energy efficiency improvement from recovered waste electricity, heat and gas from performance tests of diesel engine generators at a railway locomotive manufacturing facility in China

Version 01

12 February, 2009

A.2. Description of the small-scale project activity:

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The project activity introduces energy-conservation equipment to recover and utilize waste electricity and heat/gas which has been abandoned during performance tests of diesel engine generators at a railway locomotive manufacturing facility in China. The factory is specialized in manufacturing diesel locomotives. It also manufactures electric locomotives and repairs diesel locomotives.

In the factory, locomotives take performance tests before diesel generating unit are installed. At the moment, the electricity at the test stand is lost by water rheostat. Its frequency and output power would be stabilized and this electricity would be retrieved to be utilized in the factories by developing and installing a new inverter (commercially available inverter lacks stability). It would result in saving the electricity imported from the network to consume in the factories, and in reducing CO_2 emission. There are 4 test stands and they are in operation on steady basis.

It is estimated that the amount of electricity retrieved by this project will be 2,700MWh and all of the recovered electricity will replace the electricity from the existing grid.

At the same time, waste heat and waste gas generated on testing diesel generating unit are also recovered and utilized to replace the heat supplied by existing steam from boiler in plant.

Now, the installation of the system is planned by March 2010, and the full activation by April 2010.

The project activity results in emission reduction of 19,456 tCO_2 annually.

The project supports sustainable development in China, reducing coal consumption, as well as SO_2 and NO_x emissions. Additionally, the project will contribute to China's further sustainable development by a reduction in coal ash production from the power plant, which is currently a serious environmental problem in China.

A.3. Project participants:

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Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
China (host)	Factory A	No
	ESCO (Factory B:Joint Company of China and Japan)	No
Japan	The New Energy and Industrial Technology Development Organization (NEDO)	Yes

A.4. Technical description of the small-scale project activity:

A.4.1. Location of the small-scale project activity:

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A.4.1.1. Host Party(ies):

>>

China

A.4.1.2. Region/State/Province etc.:

>>

N.A.

A.4.1.3. City/Town/Community etc:

>>

N.A.

A.4.1.4. Details of physical location, including information allowing the unique identification of this small-scale project activity :

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A.4.2. Type and category(ies) and technology/measure of the small-scale project activity:

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Type : TYPE III - OTHER PROJECT ACTIVITIES
Category : III.Q. Waste Energy Recovery (gas/heat/pressure) Projects (Version 02)
Sectoral Scope: 04

The project activity introduces an inverter to recover and utilize electricity which has been abandoned during performance tests of diesel engine generators at the railway locomotive manufacturing facility, The recovered electricity replaces electricity from power grid to improve the efficiency of electricity generation.

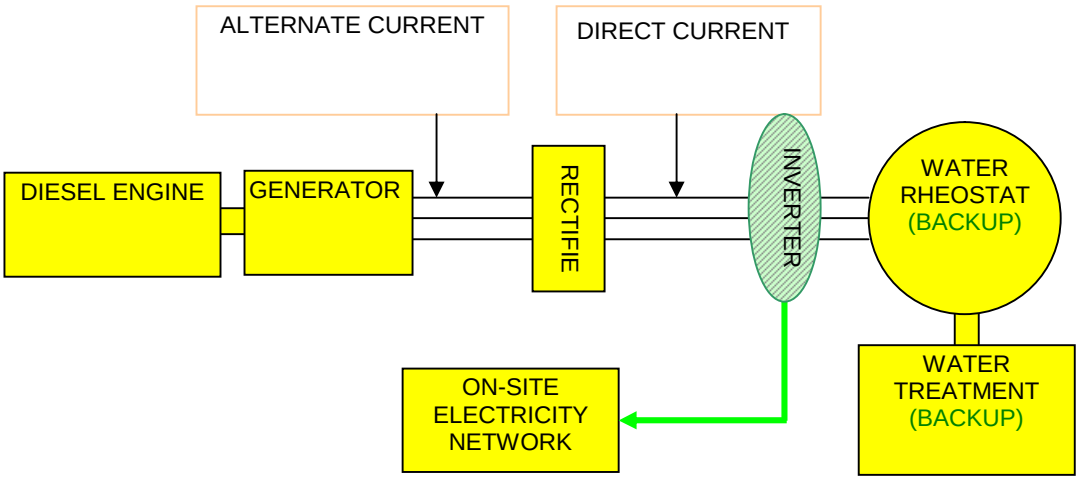

Figure 1: Conceptual Diagram of the Project Activity (Recovery of Waste Electricity)

A.4.3 Estimated amount of emission reductions over the chosen crediting period:

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Years	Estimation of annual emission reductions in tonnes of CO_2 e
2010	14,592
2011	19,456
2012	19,456
2013	19,456
2014	19,456
2015	19,456
2016	19,456
2017	19,456
2018	19,456
2019	19,456
2020	4,864
Total estimated reductions (tonnes of CO_2 e)	194,564
Total number of crediting years	10 years
Annual average of the estimated reductions over the crediting period (tCO_2 e)	19,456

A.4.4. Public funding of the small-scale project activity:

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No public funding is involved.

A.4.5. Confirmation that the small-scale project activity is not a debundled component of a large scale project activity:

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According to "Compendium of guidance on the debundling for SSC project activities (Annex 27, EB36)", a proposed small-scale project activity shall be deemed to be a debundled component of a large project activity if there is a registered small-scale CDM project activity or an application to register another small-scale CDM project activity:

(a) With the same project participants;
(b) In the same project category and technology/measure; and
(c) Registered within the previous 2 years; and
(d) Whose project boundary is within 1 km of the project boundary of the proposed small-scale activity at the closest point.

There is no registered small-scale CDM project activity or an application to register another small-scale CDM project activity in the same project category and technology/measure within 1 km of the project boundary.

The proposed project activity is not a debundled component of a large scale project activity.

SECTION B. Application of a baseline and monitoring methodology

B.1. Title and reference of the approved baseline and monitoring methodology applied to the small-scale project activity:

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AMS-III.Q. Waste Energy Recovery (gas/heat/electricity/pressure) Projects

B.2 Justification of the choice of the project category:

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The applicabilities of AMS-III.Q. are as follows. The project can meet all the aspects below.

- The category is for project activities that utilize waste gas and/or waste heat and/or waste electricity at existing facilities as an energy source for:
  - (a) Cogeneration; or
  - (b) Generation of electricity; or
  - (c) Direct use as process heat; or
  - (d) Direct use as process electricity; or
  - (e) For generation of heat in elemental process (e.g. steam, hot water, hot oil, hot air).
  - (f) For generation of mechanical energy
- The category is also applicable to project activities that use waste pressure to generate electricity at existing facilities.
- The recovery of waste gas/heat/electricity may be a new initiative or an incremental gain in an existing practice.

- In case the project activity is an incremental gain, the difference between the technology used before project activity implementation and the project technology should be clearly shown. It should be demonstrated why there are barriers for the project activity that did not prevent the implementation of the technology used before the project activity implementation.

- Measures are limited to those that result in emission reductions of less than or equal to 60 kt CO_2 equivalent annually. Wherever the measures lead to waste heat recovery which is incremental to an existing practice of waste heat recovery, only the incremental gains in GHG mitigation should be taken into account and such incremental gains shall result in emission reductions of less than or equal to 60 kt CO_2 equivalent annually.

- The category is applicable under the following conditions:

    (a) The energy produced with the recovered waste gas/heat/electricity or waste pressure should be measurable.

    (b) Energy generated in the project activity shall be used within the facility where the waste gas/heat/electricity or waste pressure is produced. An exception is made for the electricity generated by the project activity which may be exported to the grid.

    (c) The waste gas/heat/electricity or waste pressure utilized in the project activity would have been flared or released into the atmosphere/water in the absence of the project activity. This shall be proven by one of the following options:

        (i) By **direct measurements** of energy content and amount of the waste gas/heat/electricity or waste pressure for at least three years prior to the start of the project activity.

        (ii) **Energy balance** of relevant sections of the plant to prove that the waste gas/heat/electricity or waste pressure was not a source of energy before the implementation of the project activity. For the energy balance the representative process parameters are required. The energy balance shall demonstrate that the waste gas/heat/electricity or waste pressure was not used and also provide conservative estimations of the energy content and amount of waste gas/heat/electricity or waste pressure released.

        (iii) **Energy bills** (electricity, fossil fuel) to demonstrate that all the energy required for the process (e.g. based on specific energy consumption specified by the manufacturer) has been procured commercially. Project participants are required to demonstrate through the financial documents (e.g. balance sheets, profit and loss statement) that no energy was generated by waste gas/heat/electricity or waste pressure and sold to other facilities and/or the grid. The bills and financial statements should be audited by competent authorities.

        (iv) **Process plant** manufacturer's original specification/information, schemes and diagrams from the construction of the facility could be used as an estimate of quantity and energy content of waste gas/heat/electricity produced for rated plant capacity per unit of product produced.

- For the purpose of this category waste energy is defined as: a by-product gas/heat/electricity/pressure from machines and industrial processes having potential to provide usable energy, for which it can be demonstrated that it was wasted. For example gas flared or released into the atmosphere, the heat or pressure not recovered (therefore wasted). Gases that have intrinsic value in a spot market as energy

carrier or chemical (e.g. natural gas, hydrogen, liquefied petroleum gas, or their substitutes) are not eligible under this category.

B.3. Description of the project boundary:

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The physical, geographical site of the facility where the waste gas/ heat/ electricity is produced and transformed into useful energy, i.e. the locomotive plant delineates the project boundary.

B.4. Description of baseline and its development:

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Baseline Scenario

The most reasonable baseline scenario for the project activities will be evaluated by examining alternative scenarios, using steps one to three of the latest version of "Combined tool to identify the baseline scenario and demonstrate additionality". If the baseline scenario identified by this tool is the same as the one used by the methodology proposed, and also it is possible to demonstrate that it is not common practice in this area to implement project activities "without registering CDM", then the methodology is applicable.

The alternative scenarios are as follows:

- Continuation of the current practice – the locomotive plant continues to be operated without recovering waste gas/ heat/ electricity;
- All or part of the project activity is implemented without CDM (e.g. implemented by ESCO on its own) ;
- Energy-saving equipment with a higher efficiency than the one introduced by the project activity is installed;

In CDM, it is necessary to demonstrate that this project won't be implemented by the commercial sector unless credit income for the project is taken in account. In this case, it should be proven that the IRR is less than the regular business standard.

It is unlikely for ESCO to implement the project on their own due to this lower IRR and also due to their lack of knowledge and experience in energy saving technologies, although it has been 12 years since they first set up their test facilities, and as a result there is only a slight chance that energy saving facilities with higher efficiency ratings than the proposed project will be introduced. Hence, the baseline scenario without the project should most likely be the continuation of the existing system.

In addition, there is no similar project like this undertaken before in China and so this would set a precedent in experimentation work for utilizing waste electricity/ heat from a testing process in an vehicle manufacturing plant.

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered small-scale CDM project activity:

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Additionality

In this section, additionality will be demonstrated by using "Combined tool to identify the baseline scenario and demonstrate additionality".

Step 1: Identification of alternative scenarios
Identified baseline scenarios are as follows:
Scenario 1: Continuation of the current practice – the locomotive plant continues to be operated without recovering waste gas/ heat/ electricity;
Scenario 2: All or part of the project activity is implemented without CDM (e.g. implemented by ESCO on its own);
Scenario 3: Energy-saving equipment with a higher efficiency than the one introduced by the project activity is installed;

Although the Chinese regulations for energy saving are becoming more stringent as epitomized in "the five-year plan", it is not mandatory to introduce a level of energy saving technology that this project activities can deliver, or even a higher standard than this project. It still remains up to the individual companies to decide what project activities and how much higher level of energy saving standards above the mandatory minimum they want to strive for.

Step 2: Barrier analysis
- Investment barriers, other than insufficient financial returns as analyzed in Step 3
- Technological barriers
- Lack of prevailing practice
- Other barriers

Scenario 3 will be excluded due to existing technical barriers.

Step 3: Investment analysis
In CDM, it is necessary to demonstrate that this project won't be implemented by the commercial sector unless credit income for the project is taken in account. In this case, it should be proven that the IRR is less than the regular business standard.

The following information is the pre-supposed data and IRR applied.
- Operation starts from: April 2010
- System set-up cost: 75.94M yen
- Income: 13.38M yen (Income in the first year would be its 75%)
- Tax rate: 30%
- CO_2 Reduction 19,456 ton/ year
- Credit Unit Price 8 EUR/ t-CO_2
- Exchange Rate 1 EUR=120 yen

	Without Credit	With Credit
IRR (10years)	-1.07%	10.83%

Above are the economic aspects of the whole project scheme which sells steam generated from waste gas/ heat as well as electricity generated from a testing facility to the plant.

The IRR of the project activity is -1.07%. Although Factory A does not have benchmark for investment, the project activity is not economically attractive. CER revenue can raise the IRR to 10.83%.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

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Baseline emissions

In the situation where the electricity is obtained from the grid and heat from a fossil fuel based element process (e.g. steam boiler, hot water generator, hot air generator, hot oil generator), baseline emissions can be calculated as follows:

(a) Waste electricity

Waste electricity will replace the electricity from the existing grid. Baseline emissions ($BE_{elec,y}$) will be calculated as follows:

$$BE_{elec,y} = f_{cap} * f_{wcm} * \sum_{j} \sum_{i} (EG_{i,j,y} * EF_{Elec,i,j,y})$$

Where:

$BE_{elec,y}$ = Baseline emissions due to the electricity replaced by waste electricity during the year *y* in tons of CO_2

$EG_{i,j,y}$ = The quantity of electricity supplied by grid (*i=gr*) in the absence of the project activity during the year *y* in MWh

$EF_{Elec,i,j,y}$ = The CO_2 emission factor for the electricity source *i* (*i*=gr (grid)) in tons CO_2/ MWh

f_{wcm} = Fraction of total electricity generated by the project activity using waste energy. This fraction is 1 if the electricity generation is purely from use of waste energy.

f_{cap} = Capping factor to exclude increased waste energy utilization in the project year y due to increased level of activity of the plant, relative to the level of activity in the base years before project start. The ratio is 1 if the waste energy generated in project year *y* is same or less than that generated in base years.

In case of waste electricity recovery, f_{cap} shall be estimated as follows:

$$f_{cap} = \frac{EG_{i,j,BL}}{EG_{i,j,y}}$$

Where:

$EG_{i,j,BL}$ = Average quantity of electricity released or discharged using a rheostat in three years prior to the start of the project activity in MWh.

(b) Waste gas/ heat

Waste gas/ heat will replace the heat supplied by existing steam from boiler in plant. Baseline emissions ($BE_{heat,y}$) will be calculated as follows:

$$BE_{heat,y} = f_{cap} * f_{wcm} * \sum_{j} \sum_{i} (HG_{i,j,y} * EF_{Heat,i,j,y})$$

Where:

$BE_{heat,y}$ = Baseline emissions due to waste steam (heat) replaced by waste gas/ heat during the year *y* in tons of CO_2

$HG_{i,j,y}$ = The quantity of heat supplied by boilers (*i=Boiler*) in the absence of the project activity during the year *y* in TJ

$EF_{Heat,i,j,y}$ = The CO_2 emission factor for the heat source *i* (*i=Boiler*) in tons CO_2/ TJ

f_{wcm} = Fraction of total heat generated by the project activity using waste energy. This fraction is 1 if the heat generation is purely from use of waste energy.

f_{cap} = Capping factor to exclude increased waste energy utilization in the project year y due to increased level of activity of the plant, relative to the level of activity in the base years before project start. The ratio is 1 if the waste energy generated in project year *y* is same or less than that generated in base years.

Since the baseline generation source is the identified existing boilers, the CO_2 emission factor shall be determined as follows:

$$EF_{Heat,i,j,y} = \frac{EF_{CO2,i,j}}{\eta_{Boiler,j}}$$

Where:

$EF_{CO2,i,j}$ = The CO_2 emission factor per unit of energy of the fossil fuel used in the heat source *i* (*i=Boiler*) in (tCO_2/ TJ)

$\eta_{Boiler,j}$ = The efficiency of the boilers that would be used in the absence of the project activity

Project emissions

There would be no emissions from this project.

Leakage emissions

No leakage emissions for this project activity.

Emission reductions

Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y - LE_y$$

Where:

ER_y Emission reductions in year *y* (t CO_2e/yr)

BE_y Baseline emissions in year *y* (t CO_2e/yr)

PE_y Project emissions in year *y* (t CO_2/yr)

LE_y Leakage emissions in year *y* (t CO_2/yr)

B.6.2. Data and parameters that are available at validation:

Data / Parameter:	$EG_{i,j,BL}$
Data unit:	MWh
Description:	The quantity of electricity supplied to the recipient j by generator, that in the absence of the project activity would have been sourced from i^{th} source (i=gr (grid)) during the year y
Source of data used:	Wattmeter
Value applied:	1,712,352
Justification of the choice of data or description of measurement methods and procedures actually applied :	Average of 2006-2008.
Any comment:	-

Data / Parameter:	$\eta_{Boiler,j}$
Data unit:	-
Description:	The efficiency of the boilers that would be used in the absence of the project activity
Source of data used:	Performance test
Value applied:	80%
Justification of the choice of data or description of measurement methods and procedures actually applied :	-
Any comment:	-

B.6.3 Ex-ante calculation of emission reductions:

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The parameters used in the calculations for emission reductions are as follows:

	Waste Electricity	
$EG_{i,j,y}$	2,700	MWh
$EF_{Elec,i,j,y}$	0.9928	tCO_2/ MWh
f_{wcm}	1	(*1)
f_{cap}	1	(*2)
$BE_{elec,y}$	2,681	tCO_2/ year
$PE_{elec,y}$	0	tCO_2/ year

*1) All $EG_{i,j,y}$ will be generated by the waste electricity

*2) Assuming the amount of waste electricity production remains the same as before implementation of the project

	Waste Gas	Waste Heat	
Steam	1,670	16,460	ton
$HG_{i,j,y}$	12	114	TJ
$EF_{CO2,i,j}$	106.5		tCO_2/ TJ
f_{wcm}	1		(*3)
f_{cap}	1		(*4)
$\eta_{Boiler,j}$	80		%
$EF_{Heat,i,j,y}$	133.1		tCO_2/ TJ
$BE_{heat,y}$	1,545	15,231	tCO_2/ year
$PE_{heat,y}$	0	0	tCO_2/ year

*3) All $HG_{i,j,y}$ will be generated by waste gas/ heat

*4) Assuming the amount of waste gas/ heat productions stays the same as before implementation of the project.

Recovery and Utilization of:		
Waste electricity	2,681	tCO_2/ year
Waste gas	1,545	tCO_2/ year
Waste heat	15,231	tCO_2/ year
Total	19,456	tCO_2/ year

B.6.4 Summary of the ex-ante estimation of emission reductions:

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Year	Estimation of project activity emissions (tonnes of CO_2e)	Estimation of baseline emissions (tonnes of CO_2e)	Estimation of leakage (tonnes of CO_2e)	Estimation of overall emission reductions (tonnes of CO_2e)
2010	0	14,592	0	14,592
2011	0	19,456	0	19,456
2012	0	19,456	0	19,456
2013	0	19,456	0	19,456
2014	0	19,456	0	19,456
2015	0	19,456	0	19,456
2016	0	19,456	0	19,456
2017	0	19,456	0	19,456
2018		19,456	0	19,456
2019	0	19,456	0	19,456
2020	0	4,864	0	4,864
Total (tonnes of CO_2e)	**0**	**194,564**	**0**	**194,564**

B.7 Application of a monitoring methodology and description of the monitoring plan:

B.7.1 Data and parameters monitored:

Data / Parameter:	$EG_{i,j,y}$
Data unit:	MWh
Description:	The quantity of electricity supplied to the recipient j by generator, that in the absence of the project activity would have been sourced from i^{th} source (i=gr (grid)) during the year y
Source of data to be used:	Wattmeter
Value of data	1,712
Description of measurement methods and procedures to be applied:	-
QA/QC procedures to be applied:	-
Any comment:	-

Data / Parameter:	$EF_{elec,i,j,y}$
Data unit:	tons CO_2/MWh
Description:	The CO_2 emission factor for the electricity source i (i=gr (grid)), displaced due to the project activity, during the year y
Source of data to be used:	The latest "Baseline Emission Factors for Regional Power Grids in China"
Value of data	0.9928
Description of measurement methods and procedures to be applied:	For year 2008: OM=1.1169 BM=0.8687
QA/QC procedures to be applied:	-
Any comment:	-

Data / Parameter:	$HG_{i,j,y}$
Data unit:	TJ
Description:	The quantity of heat supplied by boilers (i=*Boiler*) in the absence of the project activity during the year y in TJ
Source of data to be used:	Measured
Value of data	126
Description of measurement methods and procedures to be applied:	-
QA/QC procedures to	-

be applied:	
Any comment:	-

Data / Parameter:	$EF_{Heat,i,j,y}$
Data unit:	tons CO_2/ TJ
Description:	The CO_2 emission factor for the heat source *i* (*i=Boiler*) in tons CO_2/ TJ
Source of data to be used:	Measured
Value of data	106.5
Description of measurement methods and procedures to be applied:	-
QA/QC procedures to be applied:	-
Any comment:	-

B.7.2 Description of the monitoring plan:

>>

For baseline emissions determination, monitoring shall consist of:

- Metering the thermal and/ or electrical energy produced. In case of thermal energy the enthalpy of the thermal energy output stream like hot water/ steam should be monitored.
- Metering the amount of waste gas/ electricity or the amount of energy contained in the waste heat.

B.8 Date of completion of the application of the baseline and monitoring methodology and the name of the responsible person(s)/entity(ies)

>>

The baseline study and monitoring methodology was completed on 10 February 2009 by:

Kuniyuki Nishimura (Mr.)

Mitsubishi Research Institute, Inc.
Tokyo, Japan

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SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

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01 June, 2009.

The project starting date is the day when the contract of the facility is signed.

C.1.2. Expected operational lifetime of the project activity:

>>
20 years after the installation.

The project period is based on the system's working life time. At the moment, it is the contract is expected to be signed by June.2009, and the project period is 20 years after the installation. Therefore, the project period is from June.2009 to December.2030.

C.2 Choice of the crediting period and related information:

C.2.1. Renewable crediting period

C.2.1.1. Starting date of the first crediting period:

>>
NA

C.2.1.2. Length of the first crediting period:

>>
NA

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>
01 April, 2010

C.2.2.2. Length:

>>
10 years

We set credit acquisition period as 10 years. It is expected that the system will be installed by March.2010, so the full activation will start in April.2010. Therefore, the credit acquisition period is from 1.April.2010 to 31.March.2020. The working life time of the facility is much longer than the credit acquisition period.

SECTION D. Environmental impacts

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D.1. If required by the host Party, documentation on the analysis of the environmental impacts of the project activity:

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It is thought that there is no negative environmental effect or that it is avoidable because this project set the energy saving system inside the factories. By contrast, this project will promote environment

protection in the area because it reduces the emission SO_2 and NO_X in the power grid and the emission of coal ash.

D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

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See D.1.

SECTION E. Stakeholders' comments

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E.1. Brief description how comments by local stakeholders have been invited and compiled:

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We will arrange a briefing session for the residents in the area and the stock holders before the operation. It is expected to be hold around May.2009; after the major issues about the facility is determined.

E.2. Summary of the comments received:

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Work in Progress

E.3. Report on how due account was taken of any comments received:

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Work in Progress

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

N.A

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding is involved.

Annex 3

BASELINE INFORMATION

See B.6.3

Annex 4

MONITORING INFORMATION

See B.7.2

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